

**SECTION 05500**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
1. Steel ladders.
  2. Aluminum roof ladders
  3. Ladder safety cages.
  4. Loose bearing and leveling plates.
  5. Shelf angles.
  6. Support angles for elevator door sills.
  7. Steel framing and supports for ceiling hung toilet compartments.
  8. Steel framing and supports for overhead doors.
  9. Steel framing and supports for countertops.
  10. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  11. Metal angle corner guards.
  12. Loading-dock edge angles.
  13. Pipe bollards.
  14. Auditorium catwalk
- B. Related Sections include the following:
1. Division 5 Section "Structural Steel" for structural-steel framing system components.
  2. Division 5 Section "Metal Stairs" for metal-framed stairs with metal pan, metal plate, or grating treads.
  3. Division 5 Section "Gratings" for metal gratings.
  4. Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.
  5. Division 5 Section "Ornamental Handrails and Railings" for ornamental metal handrails and railings fabricated from stock components.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
  2. Paint products.
  3. Grout.
- B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
1. Provide templates for anchors and bolts specified for installation under other Sections.

**1.4 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."

2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

## 1.5 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

## 1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

### 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- D. Slotted Channel Framing: Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- wide slotted holes in webs at 2 inches o.c.
  1. Width of Channels: 1-5/8 inches.
  2. Depth of Channels: 1-5/8 inches.
  3. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating; 0.079-inch nominal thickness.
  4. Finish: Rust-inhibitive, baked-on, acrylic enamel.
- E. Malleable-Iron Castings: ASTM A 47, Grade 32510.
- F. Gray-Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.
- G. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
  1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- H. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

## 2.3 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalanizing welds in steel, complying with SSPC-Paint 20.

## 2.4 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3. ASME B18.2.1
- E. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- F. Plain Washers: Round, carbon steel, ASME B18.22.1.
- G. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

## 2.5 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.6 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

## 2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- J. Remove sharp or rough areas on exposed traffic surfaces.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

## 2.8 STEEL LADDERS

- A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
1. Comply with ANSI A14.3, unless otherwise indicated.
  2. For elevator pit ladders, comply with ASME A17.1.
- B. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: 3/4-inch- diameter steel bars, spaced 12 inches o.c.
- D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
- F. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
- G. Galvanize ladders, including brackets and fasteners, in the following locations:
1. Exterior.

## 2.9 ALUMINUM ROOF LADDERS

- A. Fabricate ladders for the roof locations shown, with dimensions, spacings, details and anchorages as indicated. Comply with the requirements of ANSI A14.3.

- B. Anchorage: Support each ladder at at points spaced not more than 5'-0" o.c. Use welded or bolted brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7" clearance from wall to centerline of rungs.
- C. Fixed Aluminum Ladders: Aluminum wall ladder shall be 6063-T5 alloy mill finish, with serrated aluminum rungs and cast aluminum connectors. Brackets shall be not less than 1/8 inch thick and bolted securely to wall.
  - 1. Provide serrated nonslip surfaces on top of each rung.
  - 2. Rails: Extruded aluminum channel

#### 2.10 LADDER SAFETY CAGES – STEEL LADDERS

- A. General: Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or riveting.
- B. Primary Hoops: 5/16-by-4-inch steel flat bar hoops. Provide at tops and bottoms of cages and spaced not more than 20 feet o.c.
- C. Secondary Intermediate Hoops: 5/16-by-2-inch steel flat bar hoops, spaced not more than 48 inches o.c. between primary hoops.
- D. Vertical Bars: 5/16-by-2-inch steel flat bars secured to each hoop, spaced approximately 9 inches o.c.
- E. Fasten assembled safety cage to ladder rails and adjacent construction by welding or riveting, unless otherwise indicated.

#### 2.11 LADDER SAFETY CAGES – ALUMINUM LADDERS

- A. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or riveting.
- B. Hoops: 1/4-by- 2-inch aluminum flat bar hoops. Provide at tops and bottoms of cages and spaced not more than 48 inches o.c.
- C. Vertical Bars: 3/16-by-1-1/2-inch aluminum flat bars secured to each hoop, spaced approximately 9 inches o.c.; not less than seven vertical bars.
- D. Fasten assembled safety cage to ladder rails and adjacent construction by riveting.

#### 2.12 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.

#### 2.13 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. Provide steel framing and supports indicated and as necessary to complete the Work.
- C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
  - 3. Furnish inserts if units must be installed after concrete is placed.

## 2.14 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
  - 1. Exterior.

## 2.15 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch thick steel plate welded to bottom of sleeve.

## 2.16 AUDITORIUM CATWALK

- A. Fabricate auditorium catwalk including metal plate walkway, handrails and railings and hangers and supports.
- B. Fabricate catwalk from structural-steel shapes, plates, and bars of welded and bolted construction. Fabricate to sizes, shapes, and profiles indicated. Cut, drill, and tap units to receive hangers, and similar items.
  - 1. Platform: Steel plate with painted finish.
- C. Structural Performance: Provide catwalk capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including hangers, anchors and connections:
  - 1. Walkways: Capable of withstanding a uniform load of 60 lbf/sq. ft. Limit deflection to L/360 or 1/4 inch, whichever is less.
- D. Prime Finish: Provide primed painted surfaces for all steel.
  - 1. Finish Paint: Division 9 Section "Painting"; Color: flat black

## 2.17 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.18 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless

otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

- D. Apply yellow safety paint for pipe bollards. Provide paint specified in Section 09910, Painting. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

### 3.2 SETTING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

### 3.4 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- B. Fill bollards solidly with concrete, mounding top surface.

### 3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**END OF SECTION 05500**